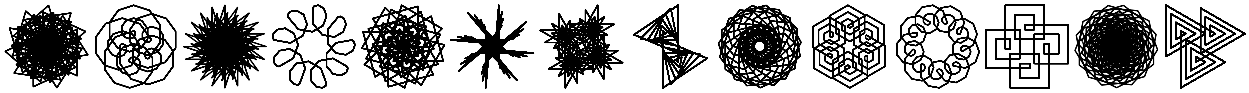
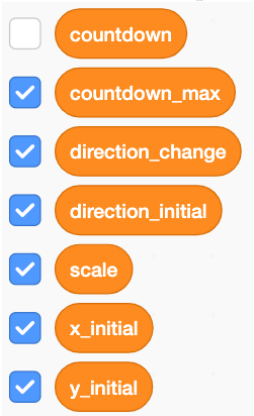
Scratch: Countdown Spirals



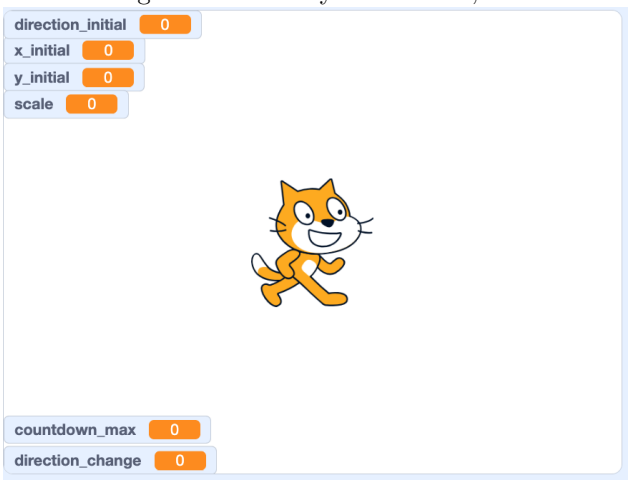
Remember the countdown spirals? In the example below, the pen moves 16 units, then 15 units, then 14 units, and the segments get smaller and smaller down to 1 unit, after which the next segment is 16 units, then 15 units, etc... and after each segment the direction is changed by 72°.

Our goal is to produce these patterns in Scratch. You will **submit a slideshow** with a variety of your best results. You need to have at least 6 high-quality images of distinct spiral patterns for full credit. Each image should also show the parameter settings used to generate the image.

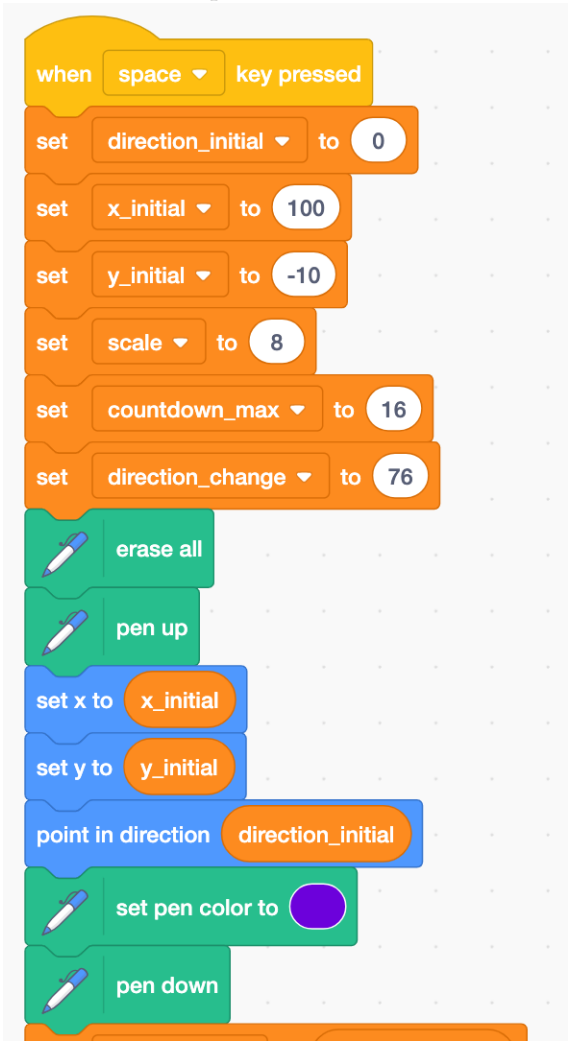
1. Go to scratch.mit.edu
   - Login (to save your work)
   - **Create a new project** (click "Create" near top of page.)
2. Click "Add Extension" button (bottom left of screen). 
   - Choose the **Pen extension**.
3. Make some variables.
   - On left side, click the "Variables" section of code. (The orange dot.)
   - For each variable we need, click "Make a Variable", and then type the variable name.
   - **Make 7 variables**:
     - `x_initial`: the x coordinate to start the drawing.
     - `y_initial`: the y coordinate to start the drawing.
     - `direction_initial`: the direction to move at start of drawing.
     - `scale`: a multiplier to make drawing bigger or smaller.
     - `direction_change`: angle turned after each segment (72 in the example above)
     - `countdown_max`: the highest number when counting down (16 in the example above)
     - `countdown`: the current countdown number. It starts at `countdown_max`, decreases by 1 after each segment is drawn, and returns to `countdown_max` after reaching 1. This `countdown` variable will change frequently during the course of producing the pattern. Each segment's length is the product of `countdown` times `scale`. The other variables are the "parameters": they will be set before the drawing begins, and not change during the drawing. This one (`countdown`) will be changed over and over by the code. The other variables acting this way are already defined by Scratch: `x position`, `y position`, and `direction`.
   - We want all the parameters to show on the screen, so keep them checked. Uncheck `countdown`.



4. In the right-most frame, rearrange the parameter readouts by clicking and dragging.
    - The drawings will be mostly circular-ish, so make room for a large circle.

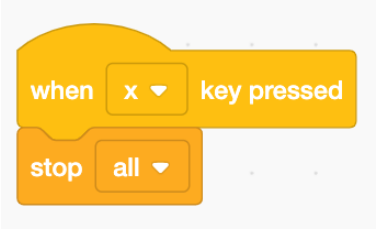


5. Start the code. In the left-most frame, find the correct elements, and drag them into place.
    - After "Space" is hit: set the parameters, clear the previous drawings, lift the pen, move the pen to the initial position and direction, and put the pen back down.
    - You will **set the paramters here** for each drawing.

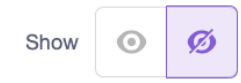


6. Code the drawing loop. (All the code from steps 5 and 6 is together in one chunk.)

7. Code a new chunk to interrupt the drawing by pressing "x".



8. Hide the sprite. (Hide the cat.)
   - Near the bottom-right frame, click the show/hide sprite toggle.



9. If your code gets busted, you can use mine: https://scratch.mit.edu/projects/1214544750

10. **DOCUMENT** your own patterns in a slideshow!
    - Adjust the parameters in the top of the code, press space bar to run the code.
      - The main parameters are `countdown_max` and `direction_change`. These fundamentally alter the pattern drawn.
      - The other parameters allow you to scale and move the drawing.
    - **DO NOT** let drawing hit edge of screen. Use a smaller `scale` value if this happens.
    - Try to make the drawing as large as possible without hitting the edge of the window or going behind the readouts.
    - Try to center the image vertically by adjusting the `y_inital` value.
    - **Document your best patterns**.
      - Start a new slideshow. Use slides.new for google slides.
      - For a title page, include your name, date, and a title... something like "Countdown Spirals"
      - When you have a high-quality spiral, take a screenshot including the readouts. Paste the screenshot into the slideshow as its own slide.
      - Before taking a screenshot, go to full-screen mode.  (Button near top-right.)
11. You can see an exemplar here:
    - https://chadworley.github.io/pbl/scratch/exemplar.html